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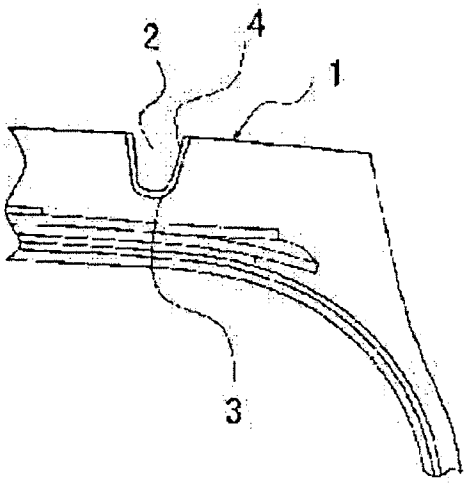
(54) PNEUMATIC TIRE FOR HEAVY LOAD, AND ITS MANUFACTURING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a pneumatic tire for heavy load improvable in crack resistance and ice-and-snow performance while maintaining various physical properties.
SOLUTION: In this pneumatic tire for heavy load, a crack resistant rubber composition or a high-hardness rubber composition different from a tread rubber composition is not disposed on a tread surface but disposed in a groove part of a tread part, and the ratio A/B of the thickness A of the crack resistant rubber composition at a groove bottom part to the thickness B of the crack resistant rubber composition at the half depth of the groove depth is 0.5-4.0.



CLAIMS

[Claim(s)]
[Claim 1]Thickness A of a crack resistance rubber composition [in / it allocates in a slot of a tread part, without allocating a different crack resistance rubber composition from a tread rubber constituent in a tread surface, and / a fillet section], a ratio with thickness B of a crack resistance rubber composition in one half of the depth of a channel depth — a pneumatic tire for heavy loading whose JIS A hardness of said crack resistance rubber composition A/B is 0.5–4.0 and is larger than JIS A hardness of said tread rubber constituent.
[Claim 2]Thickness A of a crack resistance rubber composition [in / it allocates in a slot of a tread part, without allocating a different crack resistance rubber composition from a tread rubber constituent in a tread surface, and / a fillet section], a ratio with thickness B of a crack resistance rubber composition in one half of the depth of a channel depth — A/B being 0.5–4.0 and, A pneumatic tire for heavy loading with larger content of styrene butadiene rubber in rubber polymer of said crack resistance rubber composition than content of styrene butadiene rubber in rubber polymer of said tread rubber constituent.
[Claim 3]Thickness A of a high hardness rubber composition [in / it allocates in a slot of a tread part, without allocating a different high hardness rubber composition from a high snow–and–ice performance tread rubber constituent in a tread surface, and / a fillet section], a ratio with thickness B of a high hardness rubber composition in one half of the depth of a channel depth, while A/B is 0.5–4.0, A pneumatic tire for heavy loading whose ratios of dynamic–modulus E' of said high hardness rubber composition and said high snow–and–ice performance tread rubber constituent are 1.05–2 in a high hardness rubber composition / high snow–and–ice performance tread rubber constituent.
[Claim 4]The pneumatic tire for heavy loading according to claim 3 in which said high snow–and–ice performance tread rubber constituent contains a staple fiber.
[Claim 5]By vulcanizing arranging an unvulcanized rubber of a different crack resistance rubber composition from a tread rubber constituent on the surface corresponding to a slot of a tread part of an unvulcanized tire, and pressing an unvulcanized tire outside surface to an inner surface of a metallic mold, Thickness A of said crack resistance rubber composition [in / it allocates in a slot of a tread part, without allocating said crack resistance rubber composition in a tread surface, and / a fillet section], a ratio with thickness B of said crack resistance rubber composition in one half of the depth of a channel depth — a manufacturing method of a pneumatic tire for heavy loading which fabricates A/B so that it may be set to 0.5–4.0.
[Claim 6]By vulcanizing arranging an unvulcanized rubber of a different high hardness rubber composition from a high snow–and–ice performance tread rubber constituent on the surface corresponding to a slot of a tread part of an unvulcanized tire, and pressing an unvulcanized tire outside surface to an inner surface of a metallic mold, Thickness A of a high hardness rubber composition [in / it allocates in a slot of a tread part, without allocating said high hardness rubber composition in a tread surface and / a fillet section], a ratio with thickness B of a high hardness rubber composition in one half of the depth of a channel depth, while fabricating A/B so that it may be set to 0.5–4.0, A manufacturing method of a pneumatic tire for heavy loading whose ratios of dynamic–modulus E' of said high hardness rubber composition and said high snow–and–ice performance tread rubber constituent are 1.05–2 in a high hardness rubber composition / high snow–and–ice performance tread rubber constituent.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the pneumatic tire for heavy loading which can raise crack resistance or snow-and-ice performance, maintaining the various physical properties of a tread part in more detail about the pneumatic tire for heavy loading.
[0002]
[Description of the Prior Art]In recent years, it is difficult for the pneumatic tire for heavy loading used for a track, a bus, etc. to maintain physical properties and quality of rubber by this protracted tire life last stage, although reinforcement is attained by wear-resistant improvement etc. Since tread rubber was exposed to the slot of a tread part over a long period of time especially in the outside surface, the crack of the groove bottom by run fatigue, the crack by ****** in a slot, etc. occurred, and there was a problem that it was connected with the separation of a tread part. Then, although the improvement of various tread rubber is proposed, if special rubber is used for tread rubber, the satisfactory thing is not obtained with the fall of various physical properties. For example, if hardness of tread rubber is enlarged for the crack prevention by ****** etc. or styrene butadiene rubber is blended a sake [on a cut-proof disposition], it will be inferior to low heat generation nature.
[0003]In the studless tire, in order to raise the frictional force in a snow-and-ice road surface, used high snow-and-ice performance rubber with small hardness for tread rubber, and have provided much siping in the tread part, but. By this, block rigidity falls, a block will fall during a run, the real crawler bearing area of a block will decrease, and the snow-and-ice performance of a tire will fall. Then, in order to suppress a fall lump of a block, the studless tire of raising block rigidity by blending a staple fiber with tread rubber was proposed, but there was a problem that abrasion resistance will fall. If the hardness of tread rubber tends to be raised and it is going to suppress a fall lump of a block, the pliability of rubber will be lost and snow-and-ice performance will be inferior.
[0004]
[Problem(s) to be Solved by the Invention]Therefore, there is SUBJECT of this invention in providing the pneumatic tire for heavy loading which can raise crack resistance or snow-and-ice performance, maintaining the various physical properties of a tread part.
[0005]
[Means for Solving the Problem]Thickness A of a crack resistance rubber composition [in / it allocates in a slot of a tread part, without allocating a different crack resistance rubber composition from a tread rubber constituent in a tread surface according to this invention, and / a fillet section], a ratio with thickness B of a crack resistance rubber composition in one half of the depth of a channel depth -- A/B is 0.5-4.0 and a pneumatic tire for heavy loading with larger JIS A hardness of said crack resistance rubber composition than JIS A hardness of said tread rubber constituent is provided.
[0006]Thickness A of a crack resistance rubber composition [in / it allocates in a slot of a tread part, without allocating a different crack resistance rubber composition from a tread rubber constituent in a tread surface according to this invention, and / a fillet section], a ratio with thickness B of a crack resistance rubber composition in one half of the depth of a channel depth -- A/B being 0.5-4.0 and, A pneumatic tire for heavy loading with larger content of styrene butadiene rubber in rubber polymer of said crack resistance rubber composition than content of styrene butadiene rubber in rubber polymer of said tread rubber constituent is provided.
[0007]Thickness A of a high hardness rubber composition [in / it allocates in a slot of a tread part, without allocating a different high hardness rubber composition from a high snow-and-ice performance tread rubber constituent in a tread surface according to this invention, and / a fillet section], a ratio with thickness B of a high hardness rubber composition in one half of the depth of a

channel depth, while A/B is 0.5–4.0, A pneumatic tire for heavy loading whose ratios of dynamic-modulus E' of said high hardness rubber composition and said high snow-and-ice performance tread rubber constituent are 1.05–2 in a high hardness rubber composition / high snow-and-ice performance tread rubber constituent is provided.

[0008]According to this invention, a pneumatic tire for heavy loading in which said high snow-and-ice performance tread rubber constituent contains a staple fiber is provided.

[0009]An unvulcanized rubber of a crack resistance rubber composition which is different from a tread rubber constituent according to this invention, By vulcanizing arranging on the surface corresponding to a slot of a tread part of an unvulcanized tire, and pressing an unvulcanized tire outside surface to an inner surface of a metallic mold, Thickness A of said crack resistance rubber composition [in / it allocates in a slot of a tread part, without allocating said crack resistance rubber composition in a tread surface, and / a fillet section], a ratio with thickness B of said crack resistance rubber composition in one half of the depth of a channel depth — a manufacturing method of a pneumatic tire for heavy loading which fabricates A/B so that it may be set to 0.5–4.0 is provided.

[0010]An unvulcanized rubber of a high hardness rubber composition which is different from a high snow-and-ice performance tread rubber constituent according to this invention, By vulcanizing arranging on the surface corresponding to a slot of a tread part of an unvulcanized tire, and pressing an unvulcanized tire outside surface to an inner surface of a metallic mold, Thickness A of a high hardness rubber composition [in / it allocates in a slot of a tread part, without allocating said high hardness rubber composition in a tread surface, and / a fillet section], a ratio with thickness B of a high hardness rubber composition in one half of the depth of a channel depth, while fabricating A/B so that it may be set to 0.5–4.0, A manufacturing method of a pneumatic tire for heavy loading whose ratios of dynamic-modulus E' of said high hardness rubber composition and said high snow-and-ice performance tread rubber constituent are 1.05–2 in a high hardness rubber composition / high snow-and-ice performance tread rubber constituent is provided.

[0011]

[Embodiment of the Invention]As shown in drawing 2 which is a meridian direction fragmentary sectional view of the tire near the tread part of drawing 1, and an expanded sectional view of the slot 2 of drawing 1, this invention, Different crack resistance from the tread rubber constituent of the pneumatic tire for heavy loading, Thickness A of said functional rubber composition [in / it allocates in the slot 2 of the tread part 1, without allocating in a tread surface the rubber (henceforth a functional rubber composition) which has specific functions, such as high hardness, and / the central part of the slot of the fillet section 3] 4, a ratio with thickness B of said functional rubber composition 4 in one half of the depth of a channel depth — functions, such as crack resistance and snow-and-ice performance, can be raised, maintaining the various physical properties of the tread part 1 by setting A/B to 0.5–4.0.

[0012]Since a functional rubber composition improves specific functions, such as crack resistance and high hardness, and serves as rubber at the sacrifice of other physical properties, if this is used as rubber of tread rubber itself, it will be that in which many functions as a tread part were inferior. Then, a specific function can be raised, without spoiling many functions, such as the basic property as a tread, i.e., a tread surface, the characteristic of a block, etc., by arranging this functional rubber composition only to a slot, without arranging in the tread part surface. By vulcanizing arranging a functional rubber composition on the tread part surface of an unvulcanized tire, and pressing an unvulcanized tire outside surface to the inner surface of a metallic mold here, for example, While making the slot form, when it is made to make a functional rubber composition allocate in a slot, a functional rubber composition layer will be extended by the projection for the groove shapes of a metallic mold, and, in the portion near a fillet section, the functional rubber composition layer thickness of a slot will become small by it. An exhibiting [the function of the rubber]-fully sake if a functional rubber composition layer becomes thin, the ratio of thickness A of said functional rubber composition in a fillet section, and thickness B of said functional rubber composition in one half of the depth of a channel depth — it is necessary in A/B to secure 0.5–4.0, and desirable 1.0–2.0 and sufficient thickness.

[0013]For that purpose, by vulcanizing arranging quantity which serves as thickness sufficient after vulcanizing an unvulcanized functional rubber composition on the surface corresponding to the slot of the tread part of an unvulcanized tire, and pressing an unvulcanized tire outside surface to the inner surface of a metallic mold, Without being allocated in a tread surface so that it may not have an adverse effect on a tire run, the functional rubber composition of an initial complement can be made to be able to allocate in a slot, and crack resistance ability, snow-and-ice performance, etc. can be

improved. For example, what is necessary is just to depend the thickness of the functional rubber composition allocated in the portion equivalent to the central part of a fillet section for enlarging etc.
[0014]Although thickness A in particular of the functional rubber composition in a fillet section is not limited, it is preferred to be preferably referred to as 2-3 mm in respect of crack resistance 1 mm or more.
[0015]the rubber with the larger JIS A hardness as a crack resistance rubber composition used as a functional rubber composition than the JIS A hardness of said tread rubber constituent -- desirable -- two or more -- further -- desirable -- 5-10 -- big rubber can be mentioned. What is necessary is just to adjust the hardness of rubber to arbitrary hardness by changing suitably the kind and quantity of reinforcement nature bulking agents, such as rubber polymer and carbon black, a plasticizer, etc.
[0016]As other crack resistance rubber compositions, the content of the styrene butadiene rubber in rubber polymer, larger rubber than the content of the styrene butadiene rubber in rubber polymer of said tread rubber constituent -- content can mention the rubber of ten weight sections and further 15 to 25 weight section to rubber 100 weight section preferably. By making the content of styrene butadiene increase, it is because rubber serves as high hardness.
[0017]It is preferred that can use the rubber which heightened the frictional force snow-and-ice on the street it is used as a tread of a studless tire as a high snow-and-ice performance tread rubber constituent of this invention, and dynamic-modulus E' uses the thing of 8.0 - 10.0MPa. Snow-and-ice performance can be raised without reducing block rigidity by arranging a high hardness rubber composition only to the slot of the tread which consists of a high snow-and-ice performance tread rubber constituent.
[0018]A high hardness rubber composition / high snow-and-ice performance tread rubber constituent can protect the ratio of dynamic-modulus E' of a high hardness rubber composition and a high snow-and-ice performance tread rubber constituent, a fall lump of a block can be prevented by 1.05-2, and being preferably referred to as 1.5-1.9, and snow-and-ice performance can be raised.
[0019]As a high snow-and-ice performance tread rubber constituent, what blended the staple fiber into rubber can use it conveniently. Although not limited, especially as a staple fiber as the construction material, Metal fibers, such as chemical fibers, such as polyvinylalcohol fibers, such as a polyamide fiber, polyester fiber, vinylon, etc. which are represented by natural fibers, such as cotton and silk, a cellulosic fiber, and the nylon fiber, carbon fiber, copper, and steel, etc. can be mentioned. As for these staple fibers, it is desirable for the ranges of 1 micrometers or more of 1,000-3,000 micrometers and aspect ratios (namely, the major axis / minor-axis ratio of a staple fiber) to be [the average diameter / 20-150 micrometers and average length] 40-200 preferably. [100-5,000 micrometers of]
[0020]The loadings of the staple fiber used in this invention are three to 7 weight section preferably two to 10 weight section to raw material rubber 100 weight section. The Hikami performance can be raised by making these loadings more than the amount part of duplexs, and the physical properties of rubber, especially abrasion resistance can be improved by considering it as ten or less weight sections conversely.
[0021]As raw material rubber blended with the rubber composition concerning this invention, It can be considered as the arbitrary rubbers generally used as an object for tire treads from the former, and diene system rubbers, such as crude rubber (NR), polyisoprene (IR), polybutadiene (BR), and various styrene butadiene copolymer rubbers (SBR), can specifically be used. To this rubber composition, like the further conventional case, a bulking agent, vulcanization, or a cross linking agent, It can be used for being able to blend the various additive agents generally blended to tire treads, such as vulcanization or a bridge construction accelerator, various oil, an antiaging agent, and a plasticizer, kneading and vulcanizing this compound by a general method, considering it as a constituent, and vulcanizing or constructing a bridge. The loadings of these additive agents can also be made into the conventional general loadings unless it is contrary to the purpose of this invention.
[0022]
[Example]It cannot be overemphasized that it is not what limits the range of this invention to these examples hereafter although an example explains this invention further.
ElevenR22.5 [like Table 1] whose ratio of the thickness of A/B is and which arranges the crack resistance rubber composition of the combination (weight section) shown in Examples 1-4 and the comparative example 1 - the 2 following table 1 on the slot of the tread part of an unvulcanized tire, and vulcanizes it The examination tire of 14PR was produced and each following examination was presented.
[0023]Fill up 20 cut-proof sex-test tires with the pneumatic pressure of 686KPa, respectively, and the front wheel of vehicles is equipped, After carrying out load of the maximum mass (maximum load)

of the JATMA Y/B version regulation in the 2000 fiscal year and running the whole distance 99% of a paving road, and 1% of a bad road 30,000 km, The generation state of the crack in a groove bottom was investigated with the naked eye, the tire number which the crack generated was counted, the reciprocal was searched for, and the index which makes the value of the comparative example 1 a standard (100) showed. Excelling in crack resistance is shown, so that this index is large.
After running a dry road surface 10000 km on condition of the maximum load of the wear-resistant JATMA Y/B version regulation in the 2000 fiscal year, and the maximum pneumatic pressure, the index when the amount of tire wears of the comparative example 1 was set to 100 showed each amount of tire wears. It is shown that abrasion resistance is so good that this index is large.
[0024]The wheel of rim size 20x7.00T is equipped with an exothermic test tire, You made it run on condition of pneumatic pressure 0.71MPa, 2700 kg of initial load, and speed 100 km/hr, and made it increase load at a time by 135 kg for every hour, the temperature of the tread part in the neighborhood was measured to the edge part of the cloth ply belt layer, and the load from which this temperature will be 110 ** was searched for. The index which sets to 100 the comparative example 1 which has not provided the cover rubber layer showed this evaluation result. Low heat generation nature is excellent, so that this index number is large.
[0025]
[Table 1]

表1

	比較例1	比較例2	実施例1	実施例2	実施例3	実施例4
トレッドゴム						
NR	100	—	80	80	100	100
SBR	—	100	20	20	—	—
カーボンブラック	52	60	53	53	52	52
プロセス油	—	6	6	6	—	—
亜鉛華	3	3	3	3	3	3
ステアリン酸	3	2	2.5	2.5	3	3
老化防止剤	1.5	1.5	1.5	1.5	1.5	1.5
硫黄	1.2	1.6	1.3	1.3	1.2	1.2
加硫促進剤	1.2	1.4	1.2	1.2	1.2	1.2
硬度	65	70	65	65	65	65
耐クラック性ゴム						
NR	100	90	100	90	75	75
SBR	—	10	—	10	25	25
カーボンブラック	52	52	54	52	52	52
亜鉛華	3	3	3	3	3	3
ステアリン酸	3	3	3	3	3	3
老化防止剤	1.5	1.5	1.5	1.5	1.5	1.5
硫黄	1.2	1.2	1.2	1.2	1.2	1.2
加硫促進剤	1.2	1.2	1.2	1.2	1.2	1.2
硬度	65	67	66	67	68	68
A／B	0.33	0.5	2	2	2	0.5
硬度の比(耐クラック/トレッド)	1.00	0.96	0.96	0.99	1.05	1.05
耐カット性	100	123	110	117	117	125
耐摩耗性	100	78	86	86	100	100
耐発熱性	100	80	95	89	100	100

[0026]The following were used for each ingredient used for the above-mentioned table 1. NR:RSS#3 SBR:Nipol 1502, Nippon Zeon Co., Ltd. make carbon black:SAF class, Ceased one 9, process oil by Tokai Carbon Co., Ltd. : Aroma oil, DESOFU REXX No. 3, The antiaging agent by SHOWA SHELL SEKIYU [K.K.] K.K.: N-phenyl- N' -(1,3-dimethyl)- P-phenylene diamine, The antigen 6C, the rubber accelerator by Sumitomo Chemical Co., Ltd. : as shown in Nocceler NS-P and the above-mentioned table 1 by an Ouchi Shinko Chemical industrial company, Example 1 and

Example 2 whose JIS A hardness (JIS K 6253) of said crack resistance rubber composition A/B is 0.5-4.0 and is larger than said tread rubber constituent, A/B is 0.5-4.0, and the SBR example 3 and Example 4 of the crack resistance rubber composition in which SBR is comparatively large were able to raise cut-proof nature (crack resistance), without reducing other physical properties substantially like the comparative example 2.

[0027]Using the high snow-and-ice performance rubber composition shown in Table 2 instead of Examples 5-9 and the comparative example 3 - 4 crack-resistance rubber composition, except having used the high snow-and-ice performance tread rubber constituent for the tread, the tire was produced like Example 1 and abrasion resistance was evaluated like the following Hikami performances and the above.

[0028]

[Table 2]

表2

	比較例3	比較例4	実施例5	実施例6	実施例7	実施例8	実施例9
トレッドゴム							
NR	60	60	60	60	60	60	60
BR	40	40	40	40	40	40	40
カーボンブラック	57	40	50	57	50	50	50
短繊維	-	5	—	—	—	—	5
プロセス油	7	7	7	7	7	7	7
亜鉛華	3	3	3	3	3	3	3
ステアリン酸	3	3	3	3	3	3	3
老化防止剤	1.5	1.5	1.5	1.5	1.5	1.5	1.5
硫黄	1.6	1.6	1.6	1.6	1.6	1.6	1.6
加硫促進剤	1.1	1.1	1.1	1.1	1.1	1.1	1.1
動的弾性率E'	9.0	3.0	6.5	9.0	6.5	6.5	6.5
高氷雪性能ゴム							
NR	100	100	100	100	100	100	100
カーボンブラック	45	50	50	50	50	50	50
短繊維	—	—	—	—	—	—	5
亜鉛華	3	3	3	3	3	3	3
ステアリン酸	3	3	3	3	3	3	3
老化防止剤	1.5	1.5	1.5	1.5	1.5	1.5	1.5
硫黄	1.2	1.2	1.2	1.2	1.2	1.2	1.2
加硫促進剤	1.2	1.2	1.2	1.2	1.2	1.2	1.2
動的弾性率E'	6.0	10.0	10.0	10.0	10.0	10.0	12.0
A/B	0.5	2.0	2.0	0.5	2.0	0.5	0.5
E'の比(高硬度/トレッド)	0.67	3.33	1.54	1.11	1.54	1.54	1.85
氷上性能	100	110	105	95	108	110	115
耐摩耗性	100	60	80	100	85	90	90

[0029]The following were used for each ingredient used for the above-mentioned table 2. NR:RSS#3 BR:Nipol 1220, the staple fiber containing Nippon Zeon Co., Ltd. make staple fiber:NR / nylon 6, UBE SHP-HA1060, the Ube Industries, Ltd. make, the average diameter of 12 micrometers, The average length of 120 micrometers, aspect ratio 100 carbon-black:SAF class, Ceased one 9, process oil by Tokai Carbon Co., Ltd. : Aroma oil, DESOFU REXX No. 3, The antiaging agent by SHOWA SHELL SEKIYU [K.K.] K.K.: N-phenyl- N' -(1,3-dimethyl)- P-phenylene diamine, the antigen 6C, Sumitomo Chemical Co., Ltd. make rubber accelerator:Nocceler NS-P, Ouchi Shinko Chemical industrial company make [0030]As shown in the above-mentioned table 2, A/B which used the high snow-and-ice performance tread rubber constituent for the tread, and allocated the high hardness rubber composition in the slot by 0.5-4.0. As for Examples 5-9 which are 1.05-2, the ratio of dynamic-modulus E' of a high hardness rubber composition / high snow-and-ice performance tread rubber constituent was able to raise the Hikami performance (snow-and-ice performance), without reducing other physical properties substantially like the comparative example 2.

[0031]

[Effect of the Invention]By allocating in the slot of a tread part and making thickness of the fillet section into predetermined thickness, without allocating the different crack resistance rubber

composition or high hardness rubber composition from a tread rubber constituent in a tread surface according to this invention, The pneumatic tire for heavy loading which can raise crack resistance or snow-and-ice performance can be obtained maintaining the various physical properties of a tread part.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention]This invention relates to the pneumatic tire for heavy loading which can raise crack resistance or snow-and-ice performance, maintaining the various physical properties of a tread part in more detail about the pneumatic tire for heavy loading.

[Translation done.]

PRIOR ART

[Description of the Prior Art]In recent years, it is difficult for the pneumatic tire for heavy loading used for a track, a bus, etc. to maintain physical properties and quality of rubber by this protracted tire life last stage, although reinforcement is attained by wear-resistant improvement etc. Since tread rubber was exposed to the slot of a tread part over a long period of time especially in the outside surface, the crack of the groove bottom by run fatigue, the crack by ****** in a slot, etc. occurred, and there was a problem that it was connected with the separation of a tread part. Then, although the improvement of various tread rubber is proposed, if special rubber is used for tread rubber, the satisfactory thing is not obtained with the fall of various physical properties. For example, if hardness of tread rubber is enlarged for the crack prevention by ****** etc. or styrene butadiene rubber is blended a sake [on a cut-proof disposition], it will be inferior to low heat generation nature.
[0003]In the studless tire, in order to raise the frictional force in a snow-and-ice road surface, used high snow-and-ice performance rubber with small hardness for tread rubber, and have provided much siping in the tread part, but. By this, block rigidity falls, a block will fall during a run, the real crawler bearing area of a block will decrease, and the snow-and-ice performance of a tire will fall. Then, in order to suppress a fall lump of a block, the studless tire of raising block rigidity by blending a staple fiber with tread rubber was proposed, but there was a problem that abrasion resistance will fall. If the hardness of tread rubber tends to be raised and it is going to suppress a fall lump of a block, the pliability of rubber will be lost and snow-and-ice performance will be inferior.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention]By allocating in the slot of a tread part and making thickness of the fillet section into predetermined thickness, without allocating the different crack resistance rubber composition or high hardness rubber composition from a tread rubber constituent in a tread surface according to this invention, The pneumatic tire for heavy loading which can raise crack resistance or snow-and-ice performance can be obtained maintaining the various physical properties of a tread part.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]Therefore, there is SUBJECT of this invention in providing the pneumatic tire for heavy loading which can raise crack resistance or snow-and-ice performance, maintaining the various physical properties of a tread part.

[Translation done.]

MEANS

[Means for Solving the Problem]Thickness A of a crack resistance rubber composition [in / it allocates in a slot of a tread part, without allocating a different crack resistance rubber composition from a tread rubber constituent in a tread surface according to this invention, and / a fillet section], a ratio with thickness B of a crack resistance rubber composition in one half of the depth of a channel depth -- A/B is 0.5-4.0 and a pneumatic tire for heavy loading with larger JIS A hardness of said crack resistance rubber composition than JIS A hardness of said tread rubber constituent is provided.
[0006]Thickness A of a crack resistance rubber composition [in / it allocates in a slot of a tread part, without allocating a different crack resistance rubber composition from a tread rubber constituent in a tread surface according to this invention, and / a fillet section], a ratio with thickness B of a crack resistance rubber composition in one half of the depth of a channel depth -- A/B being 0.5-4.0 and, A pneumatic tire for heavy loading with larger content of styrene butadiene rubber in rubber polymer of said crack resistance rubber composition than content of styrene butadiene rubber in rubber polymer of said tread rubber constituent is provided.
[0007]Thickness A of a high hardness rubber composition [in / it allocates in a slot of a tread part, without allocating a different high hardness rubber composition from a high snow-and-ice performance tread rubber constituent in a tread surface according to this invention, and / a fillet section], a ratio with thickness B of a high hardness rubber composition in one half of the depth of a channel depth, while A/B is 0.5-4.0, A pneumatic tire for heavy loading whose ratios of dynamic-modulus E' of said high hardness rubber composition and said high snow-and-ice performance tread rubber constituent are 1.05-2 in a high hardness rubber composition / high snow-and-ice performance tread rubber constituent is provided.
[0008]According to this invention, a pneumatic tire for heavy loading in which said high snow-and-ice performance tread rubber constituent contains a staple fiber is provided.
[0009]An unvulcanized rubber of a crack resistance rubber composition which is different from a tread rubber constituent according to this invention, By vulcanizing arranging on the surface corresponding to a slot of a tread part of an unvulcanized tire, and pressing an unvulcanized tire outside surface to an inner surface of a metallic mold, Thickness A of said crack resistance rubber composition [in / it allocates in a slot of a tread part, without allocating said crack resistance rubber composition in a tread surface, and / a fillet section], a ratio with thickness B of said crack resistance rubber composition in one half of the depth of a channel depth -- a manufacturing method of a pneumatic tire for heavy loading which fabricates A/B so that it may be set to 0.5-4.0 is provided.
[0010]An unvulcanized rubber of a high hardness rubber composition which is different from a high snow-and-ice performance tread rubber constituent according to this invention, By vulcanizing arranging on the surface corresponding to a slot of a tread part of an unvulcanized tire, and pressing an unvulcanized tire outside surface to an inner surface of a metallic mold, Thickness A of a high hardness rubber composition [in / it allocates in a slot of a tread part, without allocating said high hardness rubber composition in a tread surface, and / a fillet section], a ratio with thickness B of a high hardness rubber composition in one half of the depth of a channel depth, while fabricating A/B so that it may be set to 0.5-4.0, A manufacturing method of a pneumatic tire for heavy loading whose ratios of dynamic-modulus E' of said high hardness rubber composition and said high snow-and-ice performance tread rubber constituent are 1.05-2 in a high hardness rubber composition / high snow-and-ice performance tread rubber constituent is provided.
[0011]
[Embodiment of the Invention]As shown in drawing 2 which is a meridian direction fragmentary sectional view of the tire near the tread part of drawing 1, and an expanded sectional view of the slot

2 of drawing 1, this invention, Different crack resistance from the tread rubber constituent of the pneumatic tire for heavy loading, Thickness A of said functional rubber composition [in / it allocates in the slot 2 of the tread part 1, without allocating in a tread surface the rubber (henceforth a functional rubber composition) which has specific functions, such as high hardness and / the central part of the slot of the fillet section 3] 4, a ratio with thickness B of said functional rubber composition 4 in one half of the depth of a channel depth — functions, such as crack resistance and snow-and-ice performance, can be raised, maintaining the various physical properties of the tread part 1 by setting A/B to 0.5-4.0.

[0012]Since a functional rubber composition improves specific functions, such as crack resistance and high hardness, and serves as rubber at the sacrifice of other physical properties, if this is used as rubber of tread rubber itself, it will be that in which many functions as a tread part were inferior. Then, a specific function can be raised, without spoiling many functions, such as the basic property as a tread, i.e., a tread surface, the characteristic of a block, etc., by arranging this functional rubber composition only to a slot, without arranging in the tread part surface. By vulcanizing arranging a functional rubber composition on the tread part surface of an unvulcanized tire, and pressing an unvulcanized tire outside surface to the inner surface of a metallic mold here, for example, While making the slot form, when it is made to make a functional rubber composition allocate in a slot, a functional rubber composition layer will be extended by the projection for the groove shapes of a metallic mold, and, in the portion near a fillet section, the functional rubber composition layer thickness of a slot will become small by it. An exhibiting [the function of the rubber]-fully sake if a functional rubber composition layer becomes thin, the ratio of thickness A of said functional rubber composition in a fillet section, and thickness B of said functional rubber composition in one half of the depth of a channel depth — it is necessary in A/B to secure 0.5-4.0, and desirable 1.0-2.0 and sufficient thickness.

[0013]For that purpose, by vulcanizing arranging quantity which serves as thickness sufficient after vulcanizing an unvulcanized functional rubber composition on the surface corresponding to the slot of the tread part of an unvulcanized tire, and pressing an unvulcanized tire outside surface to the inner surface of a metallic mold, Without being allocated in a tread surface so that it may not have an adverse effect on a tire run, the functional rubber composition of an initial complement can be made to be able to allocate in a slot, and crack resistance ability, snow-and-ice performance, etc. can be improved. For example, what is necessary is just to depend the thickness of the functional rubber composition allocated in the portion equivalent to the central part of a fillet section for enlarging etc.

[0014]Although thickness A in particular of the functional rubber composition in a fillet section is not limited, it is preferred to be preferably referred to as 2-3 mm in respect of crack resistance 1 mm or more.

[0015]the rubber with the larger JIS A hardness as a crack resistance rubber composition used as a functional rubber composition than the JIS A hardness of said tread rubber constituent — desirable — two or more — further — desirable — 5-10 — big rubber can be mentioned. What is necessary is just to adjust the hardness of rubber to arbitrary hardness by changing suitably the kind and quantity of reinforcement nature bulking agents, such as rubber polymer and carbon black, a plasticizer, etc.

[0016]As other crack resistance rubber compositions, the content of the styrene butadiene rubber in rubber polymer, larger rubber than the content of the styrene butadiene rubber in rubber polymer of said tread rubber constituent — content can mention the rubber of ten weight sections and further 15 to 25 weight section to rubber 100 weight section preferably. By making the content of styrene butadiene increase, it is because rubber serves as high hardness.

[0017]It is preferred that can use the rubber which heightened the frictional force snow-and-ice on the street it is used as a tread of a studless tire as a high snow-and-ice performance tread rubber constituent of this invention, and dynamic-modulus E' uses the thing of 8.0 - 10.0MPa. Snow-and-ice performance can be raised without reducing block rigidity by arranging a high hardness rubber composition only to the slot of the tread which consists of a high snow-and-ice performance tread rubber constituent.

[0018]A high hardness rubber composition / high snow-and-ice performance tread rubber constituent can protect the ratio of dynamic-modulus E' of a high hardness rubber composition and a high snow-and-ice performance tread rubber constituent, a fall lump of a block can be prevented by 1.05-2, and being preferably referred to as 1.5-1.9, and snow-and-ice performance can be raised.

[0019]As a high snow-and-ice performance tread rubber constituent, what blended the staple fiber into rubber can use it conveniently. Although not limited, especially as a staple fiber as the construction material, Metal fibers, such as chemical fibers, such as polyvinylalcohol fibers, such as a polyamide fiber, polyester fiber, vinylon, etc. which are represented by natural fibers, such as cotton

and silk, a cellulosic fiber, and the nylon fiber, carbon fiber, copper, and steel, etc. can be mentioned. As for these staple fibers, it is desirable for the ranges of 1 micrometers or more of 1,000-3,000 micrometers and aspect ratios (namely, the major axis / minor-axis ratio of a staple fiber) to be [the average diameter / 20-150 micrometers and average length] 40-200 preferably. [100-5,000 micrometers of]

[0020]The loadings of the staple fiber used in this invention are three to 7 weight section preferably two to 10 weight section to raw material rubber 100 weight section. The Hikami performance can be raised by making these loadings more than the amount part of duplexs, and the physical properties of rubber, especially abrasion resistance can be improved by considering it as ten or less weight sections conversely.

[0021]As raw material rubber blended with the rubber composition concerning this invention, It can be considered as the arbitrary rubbers generally used as an object for tire treads from the former, and diene system rubbers, such as crude rubber (NR), polyisoprene (IR), polybutadiene (BR), and various styrene butadiene copolymer rubbers (SBR), can specifically be used. To this rubber composition, like the further conventional case, a bulking agent, vulcanization, or a cross linking agent, It can be used for being able to blend the various additive agents generally blended to tire treads, such as vulcanization or a bridge construction accelerator, various oil, an antiaging agent, and a plasticizer, kneading and vulcanizing this compound by a general method, considering it as a constituent, and vulcanizing or constructing a bridge. The loadings of these additive agents can also be made into the conventional general loadings unless it is contrary to the purpose of this invention.

[Translation done.]

EXAMPLE

[Example]It cannot be overemphasized that it is not what limits the range of this invention to these examples hereafter although an example explains this invention further.
ElevenR22.5 [like Table 1] whose ratio of the thickness of A/B is and which arranges the crack resistance rubber composition of the combination (weight section) shown in Examples 1-4 and the comparative example 1 - the 2 following table 1 on the slot of the tread part of an unvulcanized tire, and vulcanizes it The examination tire of 14PR was produced and each following examination was presented.
[0023]Fill up 20 cut-proof sex-test tires with the pneumatic pressure of 686KPa, respectively, and the front wheel of vehicles is equipped, After carrying out load of the maximum mass (maximum load) of the JATMA Y/B version regulation in the 2000 fiscal year and running the whole distance 99% of a paving road, and 1% of a bad road 30,000 km, The generation state of the crack in a groove bottom was investigated with the naked eye, the tire number which the crack generated was counted, the reciprocal was searched for, and the index which makes the value of the comparative example 1 a standard (100) showed. Excelling in crack resistance is shown, so that this index is large.
After running a dry road surface 10000 km on condition of the maximum load of the wear-resistant JATMA Y/B version regulation in the 2000 fiscal year, and the maximum pneumatic pressure, the index when the amount of tire wears of the comparative example 1 was set to 100 showed each amount of tire wears. It is shown that abrasion resistance is so good that this index is large.
[0024]The wheel of rim size 20x7.00T is equipped with an exothermic test tire, You made it run on condition of pneumatic pressure 0.71MPa, 2700 kg of initial load, and speed 100 km/hr, and made it increase load at a time by 135 kg for every hour, the temperature of the tread part in the neighborhood was measured to the edge part of the cloth ply belt layer, and the load from which this temperature will be 110 ** was searched for. The index which sets to 100 the comparative example 1 which has not provided the cover rubber layer showed this evaluation result. Low heat generation nature is excellent, so that this index number is large.
[0025]
[Table 1]

表1

	比較例1	比較例2	実施例1	実施例2	実施例3	実施例4
トレッドゴム						
NR	100	—	80	80	100	100
SBR	—	100	20	20	—	—
ｶｰﾎﾞﾝﾌﾞﾗｯｸ	52	60	53	53	52	52
プロセス油	—	6	6	6	—	—
亜鉛華	3	3	3	3	3	3
ステアリン酸	3	2	2.5	2.5	3	3
老化防止剤	1.5	1.5	1.5	1.5	1.5	1.5
硫黄	1.2	1.6	1.3	1.3	1.2	1.2
加硫促進剤	1.2	1.4	1.2	1.2	1.2	1.2
硬度	65	70	65	65	65	65
耐クラック性ゴム						
NR	100	90	100	90	75	75
SBR	—	10	—	10	25	25
ｶｰﾎﾞﾝﾌﾞﾗｯｸ	52	52	54	52	52	52
亜鉛華	3	3	3	3	3	3
ステアリン酸	3	3	3	3	3	3
老化防止剤	1.5	1.5	1.5	1.5	1.5	1.5
硫黄	1.2	1.2	1.2	1.2	1.2	1.2
加硫促進剤	1.2	1.2	1.2	1.2	1.2	1.2
硬度	65	67	66	67	68	68
A／B	0.33	0.5	2	2	2	0.5
硬度の比(耐ｸﾗｯｸ/ﾄﾚｯﾄﾞ)	1.00	0.96	0.96	0.99	1.05	1.05
耐カット性	100	123	110	117	117	125
耐摩耗性	100	78	86	86	100	100
耐発熱性	100	80	95	89	100	100

[0026]The following were used for each ingredient used for the above-mentioned table 1. NR:RSS#3 SBR:Nipol 1502, Nippon Zeon Co., Ltd. make carbon black:SAF class, Ceased one 9, process oil by Tokai Carbon Co., Ltd. : Aroma oil, DESOFU REXX No. 3, The antiaging agent by SHOWA SHELL SEKIYU [K.K.] K.K.: N-phenyl- N' -(1,3-dimethyl)- P-phenylene diamine, The antigen 6C, the rubber accelerator by Sumitomo Chemical Co., Ltd. : as shown in Nocceler NS-P and the above-mentioned table 1 by an Ouchi Shinko Chemical industrial company, Example 1 and Example 2 whose JIS A hardness (JIS K 6253) of said crack resistance rubber composition A/B is 0.5-4.0 and is larger than said tread rubber constituent, A/B is 0.5-4.0, and the SBR example 3 and Example 4 of the crack resistance rubber composition in which SBR is comparatively large were able to raise cut-proof nature (crack resistance), without reducing other physical properties substantially like the comparative example 2.

[0027]Using the high snow-and-ice performance rubber composition shown in Table 2 instead of Examples 5-9 and the comparative example 3 - 4 crack-resistance rubber composition, except having used the high snow-and-ice performance tread rubber constituent for the tread, the tire was produced like Example 1 and abrasion resistance was evaluated like the following Hikami performances and the above.

[0028]

[Table 2]

表2

	比較例3	比較例4	実施例5	実施例6	実施例7	実施例8	実施例9
トレッドゴム							
NR	60	60	60	60	60	60	60
BR	40	40	40	40	40	40	40
ｶｰﾎﾞﾝﾌﾞﾗｯｸ	57	40	50	57	50	50	50
短繊維	—	5	—	—	—	—	5
プロセス油	7	7	7	7	7	7	7
亜鉛華	3	3	3	3	3	3	3
ステアリン酸	3	3	3	3	3	3	3
老化防止剤	1.5	1.5	1.5	1.5	1.5	1.5	1.5
硫黄	1.6	1.6	1.6	1.6	1.6	1.6	1.6
加硫促進剤	1.1	1.1	1.1	1.1	1.1	1.1	1.1
動的弾性率E'	9.0	8.0	6.5	9.0	6.5	6.5	6.5
高氷雪性能ゴム							
NR	100	100	100	100	100	100	100
ｶｰﾎﾞﾝﾌﾞﾗｯｸ	45	50	50	50	50	50	50
短繊維	—	—	—	—	—	—	5
亜鉛華	3	3	3	3	3	3	3
ステアリン酸	3	3	3	3	3	3	3
老化防止剤	1.5	1.5	1.5	1.5	1.5	1.5	1.5
硫黄	1.2	1.2	1.2	1.2	1.2	1.2	1.2
加硫促進剤	1.2	1.2	1.2	1.2	1.2	1.2	1.2
動的弾性率E'	6.0	10.0	10.0	10.0	10.0	10.0	12.0
A／B	0.5	2.0	2.0	0.5	2.0	0.5	0.5
E'の比(高硬度/ﾄﾚｯﾄﾞ)	0.67	3.33	1.54	1.11	1.54	1.54	1.85
氷上性能	100	110	105	95	108	110	115
耐摩耗性	100	60	80	100	85	90	90

[0029]The following were used for each ingredient used for the above-mentioned table 2. NR:RSS#3 BR:Nipol 1220, the staple fiber containing Nippon Zeon Co., Ltd. make staple fiber:NR / nylon 6, UBE SHP-HA1060, the Ube Industries, Ltd. make, the average diameter of 12 micrometers, The average length of 120 micrometers, aspect ratio 100 carbon-black:SAF class, Ceased one 9, process oil by Tokai Carbon Co., Ltd. : Aroma oil, DESOFU REXX No. 3, The antiaging agent by SHOWA SHELL SEKIYU [K.K.] K.K.: N-phenyl- N' -(1,3-dimethyl)- P-phenylene diamine, the antigen 6C, Sumitomo Chemical Co., Ltd. make rubber accelerator:Nocceler NS-P, Ouchi Shinko Chemical industrial company make [0030]As shown in the above-mentioned table 2, A/B which used the high snow-and-ice performance tread rubber constituent for the tread, and allocated the high hardness rubber composition in the slot by 0.5-4.0. As for Examples 5-9 which are 1.05-2, the ratio of dynamic-modulus E' of a high hardness rubber composition / high snow-and-ice performance tread rubber constituent was able to raise the Hikami performance (snow-and-ice performance), without reducing other physical properties substantially like the comparative example 2.

[Translation done.]

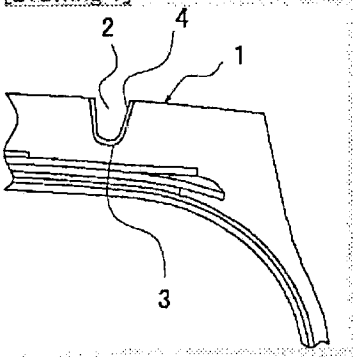
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a meridian direction fragmentary sectional view of a tire showing near a tread part.
[Drawing 2]It is an expanded sectional view of the slot of drawing 1.
[Description of Notations]
1 Tread part
2 Slot
3 Fillet section
4 A functional rubber composition

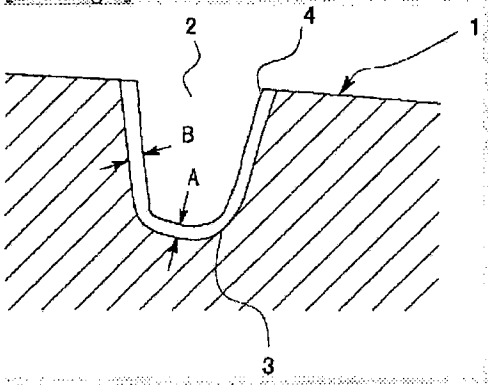
[Translation done.]

DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]